UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS.
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/673,514	09/30/2003	Hideaki Miyoshi	243294US6YA	1592

22850 7590 12/29/2006

OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER	
ARANCIBIA, MAUREEN GRAMAGLIA	
ART UNIT	PAPER NUMBER
1763	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/29/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/673,514	MIYOSHI ET AL.	
	Examiner	Art Unit	
	Maureen G. Arancibia	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 October 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8 and 11-49* is/are pending in the application.

4a) Of the above claim(s) *20-49* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8 and 11-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 April 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 1-8, 11, and 13-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Japanese Patent Application Publication 08-031753 to Tashiro et al. in view of U.S. Patent Application Publication 2003/0151372 to Tsuchiya et al. The following rejection refers to the English Machine Translation (EMT) of Tashiro et al.**

Tashiro et al. teaches a method of operating a plasma processing system (Figure 4), comprising: positioning a substrate 407 on a substrate holder (second electrode) 409 in a processing chamber 404; initializing the plasma processing system (EMT, Paragraph 44); igniting a plasma by applying to a first electrode 410 a first RF signal at a first RF frequency from a first RF source 413 (*frequency adjustable RF and the VHF common power source 413*; Paragraph 45) to ignite the plasma (*RF was first impressed...this...starts discharge*; Paragraph 45) and thereafter providing to the first electrode from the first RF source 413 a second RF signal at a second RF frequency (*When discharge began, the RF of a power source was changed to the VHF field*; Paragraph 45); and sustaining the plasma using the second signal applied to the first

electrode at the second RF frequency (*the stable VHF plasma was acquired*; Paragraph 45).

In regards to Claims 1 and 6-8, Tashiro et al. does not expressly teach that the first RF frequency is greater than the second RF frequency, greater than 40 MHz, and at least 10% higher in frequency than the second RF frequency.

Tsuchiya et al. teaches that a first RF frequency used to ignite the plasma can be 60 MHz, which is more than 10% higher in frequency than a second RF frequency of 13.56 MHz used to sustain the plasma. (Paragraph 51)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Tashiro et al. to have the first RF frequency used to ignite the plasma be greater than 40 MHz and more than 10% higher in frequency than a second RF frequency used to sustain the plasma, as taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraphs 9-15), would have been to increase plasma generation efficiency by igniting the plasma with a frequency in the VHF band, but to avoid weakening the sheath electric field by having the frequency be too high during processing.

In regards to Claims 2 and 3, Tashiro et al. teaches that the power level of the first RF signal can be 50 Watts. (EMT, Paragraphs 28, 30, and 43; *[In] Example 1...RF of 50 W was first impressed... Drawing 4 is the...diagram showing the structure of the VHF plasma-CVD equipment which is the 4th example concerning this invention. It is fundamentally the same as an example 1 except the electrode section of a membrane formation chamber.*)

In regards to Claim 4, Tashiro et al. teaches that the chamber pressure is 0.1 Torr. (Paragraph 44)

Tashiro et al. does not expressly teach that the process gas is any of the claimed process gases.

Tsuchiya et al. teaches that a process gas comprises a carbon- and fluorine-containing gas (CF_4). (Paragraph 68)

It would have been obvious to one of ordinary skill in the art to supply a carbon- and fluorine-containing gas to the plasma chamber taught by Tashiro et al., as taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraph 68), would have been to perform plasma etching, in instead of the coating taught by Tashiro et al.

In regards to Claim 5, Tashiro et al. teaches coupling the first RF signal to the first electrode 410 of the plasma processing system using a first matching network 412, and tuning the first matching network to an initial condition for plasma ignition. (EMT, Paragraph 45)

In regards to Claim 11, Tashiro et al. teaches that the first signal is provided for a first time period, and the second signal is provided for a second time period. (i.e. each from a defined start time to an end time; EMT, Paragraphs 45 and 49; Figure 8)

In regards to Claims 13 and 14, Tashiro et al. does not expressly teach the recited steps.

Tsuchiya et al. teaches that a plasma processing method can comprise: determining a forward power for a first RF signal used to ignite the plasma and being

provided by the first frequency source; determining a reflected power for the first signal being returned to the first frequency source; and determining when the plasma has been ignited using the forward power and the reflected power. (Paragraphs 59-65 and 108)

It would have been obvious to one of ordinary skill in the art to include the steps taught by Tsuchiya et al. of determining ignition using forward and reflected power in the method taught by Tashiro et al. The motivation for making such a modification, as taught by Tashiro et al. (Paragraph 60), would have been to allow the impedance of the matching unit to be optimized at the moment of plasma generation.

In regards to Claims 15 and 16, Tashiro et al. does not expressly teach the claimed steps.

Tsuchiya et al. teaches that the ignition and maintenance of the plasma are determined using at least one optical frequency obtained by an optical frequency monitoring system coupled to the processing chamber. (Paragraphs 73, 78, 79, 82)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Tashiro et al. to include the detection steps taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraphs 79-82), would have been to use an alternate means of detecting plasma generation, both to ensure plasma generation and to allow for the timed optimization of the process settings.

In regards to Claims 17 and 18, Tashiro et al. does not expressly teach the claimed steps.

Tsuchiya et al. teaches tuning the first matching network form the initial condition to an operating condition, and verifying that the plasma has not extinguished. (Paragraphs 90-97) Tsuchiya et al. also teaches that the first matching network is tuned from the initial condition to the operating condition in less than 4 seconds (about 1 second). (Paragraphs 117 and 121)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Tashiro et al. to include the tuning and verification steps as taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraph 90), would have been to optimize the impedance of the matching network at the moment of ignition to maximize the proportion of RF power coupled with the plasma and retain the plasma efficiently.

In regards to Claim 19, Tashiro et al. does not expressly teach coupling a second RF source to the second electrode (and substrate support) 409 and providing additional power to the plasma.

Tsuchiya et al. teaches that a plasma processing method further comprises coupling an RF source 50 to second electrode (and substrate support) 5; and providing additional power to the plasma. (Paragraphs 56 and 57)

It would have been obvious to one of ordinary skill in the art to couple an RF source to the second electrode taught by Tashiro et al. and to supply additional power to the plasma, as taught by Tsuchiya et al. The motivation for making such a modification, as taught by Tsuchiya et al. (Paragraph 56), would have been to generate

a self-biasing voltage at the substrate to be processed to control the ion incidence on the substrate.

3. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tashiro et al. in view of Tsuchiya et al. as applied to Claim 11 above, and further in view of U.S. Patent 5,441,596 to Nulty.

The teachings of Tashiro et al. and Tsuchiya et al. were discussed above in regards to Claim 11.

In regards to Claim 12, the combination of Tashiro et al. and Tsuchiya et al. does not expressly teach that the first time period has a duration that ranged from about 10 ms to about 1 s.

Nulty teaches that a first RF signal can be applied for a time period of 1 s. (Column 4, Lines 1-16)

It would have been obvious to one of ordinary skill in the art to modify the method taught by Tashiro et al. to have the first time period be only 1 s long. The motivation for making such a modification, as taught by Nulty (Column 2, Lines 37-45, Column 4, Lines 1-16, Column 6, Lines 47-56), would have been to consistently, repeatably ignite the plasma while still expanding the operating range of the plasma process to higher powers and lower pressures.

Response to Arguments

4. Applicant's arguments filed 10 October 2006 have been fully considered but, in so far as they still apply, they are not persuasive.

In response to applicant's arguments against the references individually, specifically that secondary reference Tsuchiya et al. does not teach that RF signals from separate RF sources are applied to a common electrode, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Specifically in regards to applicant's argument that Tashiro et al. does not teach all of the steps of the claimed method, and that Tashiro et al. teaches that the disclosed method of Tashiro et al. results in increased deposition rates of "good amorphous silicon," this is to consider only the teachings of a single reference where the rejection is based on the combination of two references, Tashiro et al. and Tsuchiya et al. It is the teachings of Tsuchiya et al. that would have motivated one of ordinary skill in the art to make the modifications to the method of Tashiro et al. as discussed in the rejection above, with a reasonable expectation of success in attaining the benefits taught by Tsuchiya et al. and discussed above. Moreover, just because a reference teaches a different way of attaining a desired result, even what the reference considers to be the best way of attaining the result, does not mean that the reference teaches *away* from any other way of attaining the desired result.

It is also noted that Tsuchiya et al. is a secondary reference relied on in the rejection of independent Claim 1 for the teaching that a higher RF frequency can be used to ignite the plasma and a lower RF frequency can be used to sustain the plasma, with the benefit of increasing plasma generation efficiency by igniting the plasma with a

frequency in the VHF band, but avoiding weakening the sheath electric field by having the frequency being too high during processing. It is the teachings of Tashiro et al. that are to be modified by the teachings of Tsuchiya et al., not the reverse. Also, applicant's statement at the top of page 13 of the Remarks filed 10 October 2006 that the purpose of Tsuchiya et al. being to "use RF waves of different frequencies at the same time" makes it non-obvious to combine the teachings of Tsuchiya et al. with Tashiro et al. to obtain the claimed method is not understood. The claimed method does not require that the first RF signal is discontinued when the second RF signal is supplied, though in any case primary reference Tashiro et al. does teach this feature. Tsuchiya et al. is relied on for the teaching of generating the plasma with a first RF signal of a higher VHF frequency, and thereafter providing a second RF signal of a lower HF frequency to sustain the plasma. (ex. Paragraph 56)

In response to applicant's argument that the matching elements and protective circuits of Tsuchiya et al. are not designed for providing protection at two different frequencies or to match the frequency change from VHF range to HF range, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Finally, the reference **U.S. Patent 5,882,424 to Taylor et al.**, previously made of record, is again noted. While a rejection over the teachings of Taylor et al. is not made

at this time to avoid any unjustified introduction of a new grounds of rejection, it is noted that Taylor et al. teaches the method recited in Claim 1, comprising the steps of igniting a plasma by applying to a first electrode a first RF signal with a higher RF frequency, and thereafter providing to the same electrode a second RF signal with a lower RF frequency to sustain the plasma. (Column 7, Lines 6-13)

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maureen G. Arancibia whose telephone number is (571) 272-1219. The examiner can normally be reached on core hours of 10-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Maureen G. Arancibia
Patent Examiner
Art Unit 1763

Parviz Hassanzadeh
Supervisory Patent Examiner
Art Unit 1763